TO STUDY THE DEVELOPING CERTAIN DESIGNS FOR PROMOTING REFLECTIVE LEARNING PRACTICES AT SECONDARY LEVEL

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ABSTRACT

Mathematics provides the platform for the formulation, structuring, and articulation of human cognition through its system of psychological tools and mathematical thinking dynamic. Mathematics competency exposes a new approach to think about mathematics learning as a goal of instruction. Learners, who are proficient in mathematics grasp fundamental concepts, are fluent in completing basic operations, have a repertoire of strategic knowledge, can reason effectively and flexibly, and have a good attitude toward mathematics. It has been discovered that instructional dynamisms based on reflective learning practises can energise the mathematics learning environment by enabling students to configure mathematical concepts, construct, deconstruct, and reconstruct solution strategies, and persevere in managing mathematical tasks. The goal of this study was to create specific learning designs for encouraging reflective learning practises among secondary school students and to see how effective they were at improving math performance. The current study used an experimental design using a mixed technique approach. The study used a quasi-experimental methodology with a non-equivalent group design for the pretest and posttest. Mathematicians, professionals in the subject of mathematics, and secondary school students made up the sample. Semi-structured interview, Analytic rubric for synchronised assessment of mathematics proficiency, Lesson designs based on select reflective learning designs such as Reflective journaling design, Problem based learning design, and Thinking maps design, Achievement test in mathematics, Scale of reflective action, Strategy evaluation proforma, and Focus group discussion were the major analytical supports and techniques used in data collection. The findings of the study lead to the conclusion that certain reflective learning designs, such as reflective journaling, problem-based learning, and thinking maps, are highly effective in improving academic performance in mathematics, increasing reflective thinking, and increasing set levels of mathematical proficiency among secondary school students.

KEYWORDS: Competency, Quasi-Experimental, Semi-Structured, Reflective Learning

INTRODUCTION

Idio-synchronisation in thinking towards the framing of new parameters that govern a powerful future is greatly enhanced by education. It lays a solid foundation for the multidimensional development of information and communication skills, thinking and problem-solving skills, interpersonal and self-directed skills, entrepreneurial skills, and self-direction, preparing students for a successful career and leadership in today's globalised world. According to Youdel (2011), education is a state and societal undertaking with a course of study and recognisable teaching, learning, and assessment modes. Education, as one of the most important components in a country's growth, is intended to provide people with the knowledge and skills they need to improve their lives, as well as the values and attitudes they need to live together. Any education intervention's purpose is to ensure that the targeted beneficiaries participate in the programme and obtain the desired reading and numeracy skills, higher order mental skills related to thinking and reasoning abilities, life skills, values, and emotional intelligence development (Sankar, 2010). When the country is in development mode, one of the most significant necessities, according to our former president Abdul Kalam (2002), is an integrated developmental plan and empowered management structures in the domain of education. He went on to say that our educational system should strive to produce enlightened citizens who are a blend of learning and value systems, with human thought aligned with the universe's harmony.

A cursory examination of the field of education reveals a slew of issues and concerns related to the core of the current emphasis on educational excellence, which provides an international learning environment and allows the fruits of research to be disseminated in society through the promotion of strong links with the economy and civil society. Educational ecologies have undergone structural reforms with a paradigm shift from didactic instructional modes to constructivist approaches that encourage learners to think in creative and pluralistic ways of pedagogy and gain a repertoire of wide-ranging competencies, in line with modern society's demands for a more global knowledge-based economy. Without a doubt, we are on the verge of discovering a plethora of new ways to enrich and expand our thinking capacities, which will dramatically increase our ways of doing and inspire us to always strive for the pinnacle of knowledge and learning. Students need a profile of abilities not only for managing this information shift, but also for decision making, problem solving, self-direction, and self-

empowerment in today's accountability-driven culture, as they have never needed them before this century. Educators give contextual strategic scaffolding for learners to participate in automatic processing, dialectical reasoning, divergent thinking, and critical understanding rather than arbitrating knowledge. Educational institutions should presumably be oases of knowledge development and pulsars of high-quality learning, spitting out global-valid solutions to a society beset by problems.

SCOPE OF THE STUDY

The study's main goal was to develop specific learning designs for secondary school students to empower them with reflective learning practises and to examine the usefulness of the selected designs in pursuing mathematics competency. The efficiency of selected reflective learning designs was evaluated in terms of increasing the level of reflective thinking and improving the students' academic performance in mathematics. The investigator created learning designs based on selected reflective learning methodologies, such as reflective journaling, problem-based learning, and thinking maps, in the current study. Action learning is underpinned by reflective learning practise, which is an intentional event in which emotions and cognitions are strongly interrelated and interactive. Select reflective learning designs form the intellectual landscape of instructional roles, requiring students to simultaneously build crucial insights, abilities, strategies, dispositions, and understanding in order to continue learning. The study's findings reveal that instructional dynamisms resulting from reflective learning practises can help learners develop skills in self-management, self-regulation, lifelong learning, and self-evaluation. Though there are some difficulties and constraints in implementing reflective pedagogy, the major benchmarks of the select mechanisms will equip future learners and teachers to focus on review, reflection, target setting, and action planning for future work creatively, as well as to make sense of one's own experience of learning, which encompasses a broader range of issues such as goals, feelings, social relations, and learning context. As a result, policymakers, curriculum developers, and teachers can create designs for metacognitive growth, which is a way for students to exhibit their learning while also involving processes and modes of learning that urge them to accept responsibility for their own ongoing learning.

STATEMENT OF THE PROBLEM

Mathematics is the universal way of cognition and an essential component of all scientific attempts in the Universe, thus those who are not adept in it are cut off from the entire sphere of human activity. The goal of obtaining mathematics competency for all pupils places far more demanding performance demands on all instructional instruments. It has been discovered that instructional dynamisms based on reflective learning practises can energise the mathematics learning space by enabling students to configure mathematical concepts, construct, deconstruct, and reconstruct solution strategies, and persevere in completing mathematical assignments. In this job, the researcher aimed to develop pedagogical frameworks that were in sync with reflective attitudes in secondary school mathematics learning. The current study is named *"Developing Certain Designs for Promoting Reflective Learning Practices at the Secondary Level"* and is based on these observations, a review of related studies, and the research questions formulated.

REVIEW OF LITERATURE

Ahmed, Faran & Muhammad, Yaar & Anis, Faisal. (2020). The goal of this collaborative action research study was to build reflective teaching practise with nine secondary school teachers in a private school through focus group talks as a kind of reflection conversations. In this study, data was collected using two self-constructed open-ended questionnaires: one before the focus group discussions and the other after the focus group discussions. Teachers teaching English, Urdu, Science, Social Studies, and Pakistan Studies participated in focus group discussions. Audiotapes of focus group discussions were then transcribed for coding and theme analysis. Certain conclusions were reached as a result of the analysis. Professional development was determined to be beneficial, as participants eagerly adopted this new notion of reflective teaching for their own development as well as the development of their pupils. Reflective teaching, according to the majority of participants, is good to analytical skills since it allows them to examine performance and identify how to improve in the future. Furthermore, they believed that it could aid in the development of pupils' analytical skills. It is hoped that the detailed descriptions provided by the participants in this study will assist the chosen school in improving teacher performance in the form of better learning goals and

student grooming so that they will be well prepared for a higher level of education and then professional education in the long run.

Rodgers, Carol & Laboskey, Vicki. (2016). This chapter focuses on the specific attitudes, aims, practises, and systems that individuals pursuing reflective teacher education may or may not need to implement into their programmes in order to be consistent with the relevant conceptions. The writers revisit core notions of reflection and reflective practise from John Dewey, Donald Schön, Paolo Freire, Maxine Greene, Marilyn Cochran-Smith, and Susan Lytle in the first part of this chapter. They examine how reflection is viewed, its role in education, and its consequences for teacher education in each scenario. The authors then go on to describe three nested levels of contemporary reflection conceptualizations and models of practise: reflection in students' learning (descriptive feedback, knowledge building, and Knowledge Forum), reflection in teachers' learning (core reflection, descriptive inquiry, and action research), and reflection in teacher educators' learning (core reflection, descriptive inquiry, and action research) (self-study). They end by arguing that reflection is about transforming what educators are currently doing, first and foremost by being more aware of themselves, others, and the world in which they live, together, rather than adding something new and externally derived.

Kuswandono, Paulus. (2012). Over the last two decades, studies on reflective practise in teacher education have gotten a lot more attention. This article examines the notion of reflection and how it is taught to pre-service teachers during their early stages of professional development. Pre-service teachers should use reflection to not only illuminate their professional learning experiences, but also to critically reflect on their vocation as teachers, especially the values that may be imposed on them by rigid laws. Reflection is important in teacher education because it is linked to learning since students use reflection to exercise their minds and evaluate their learning experiences. In addition, this article discusses some of the perceived challenges of implementing reflective practise, as well as strategies for promoting reflection.

Pavlovich, Kathryn & Collins, Eva & Jones, Glyndwr. (2009). In this article, "how might successful design and assessment of reflective journals aid the development of students' self-knowledge?" is explored as a tool for fostering self-awareness in a business education

context. The authors describe three distinct methods to learning journals, with each case study describing the goal of the course and the learning journal inside it, as well as the journal's design and assessment, and an assessment of the experience. The goal of the writers is to show how journals can be used in management education. Despite the fact that each case study is unique, three interconnected themes emerge that explain why this approach to learning is so important: finding the subjective voice that allows students to access their inner learning; accepting that learning is mutually constructed within a cocreative space rather than something "done to the student"; and that a higher sense of personal purpose is engendered by a more reflective self-awareness. These notable outcomes demonstrate the effectiveness of this learning strategy.

OBJECTIVES OF THE STUDY

The purpose of this study is to examine the most common pedagogical roles for implementing mathematics curriculum at the secondary school level in order to improve mathematical competency.

RESEARCH METHODOLOGY

The purpose of this project was to equip secondary school students with reflective learning methods in order to achieve advanced mathematical competency by designing three learning designs: reflective journaling, problem-based learning, and thinking maps. The investigator used both quantitative and qualitative methodology to achieve the investigation's goals. The quantitative component of the study used a quasi-experimental methodology using a pre-test post-test non-equivalent group design, while the qualitative segment included semi-structured interviews, surveys, and focus group discussions. The study's sample mostly consisted of 284 secondary school students. A select group of specialists [N=81] was involved in the study, which includes mathematics experts, teacher educators at the B.Ed. and M.Ed. levels, and secondary school practitioners. In addition, the study sample consisted of six cohorts of secondary school students from each of the experimental groups.

RESULT & ANALYSIS

TABLE 1.1- TEACHERS' PERSPECTIVES ON THE FUNCTIONAL DIMENSIONS OF MATHEMATICALLY PROFICIENT LEARNERS

Sl. No.	Functional dimensions of mathematically proficient learner	% of teachers opined
1	Explains mathematical problems	95
2	Integrates and functionalizes mathematics concepts	89
3	Uses multiple representation of mathematical tasks	91
4	Uses appropriate algorithms	90
5	Formulates plan of action for solving problem	85
6	Estimates results accurately	92
7	Selects and applies suitable principles to solve mathematical issues	87
8	Explains mathematical procedures	82
9	Communicate mathematical ideas effectively	85
10	Justifies conclusions	81
11	Use heuristic approaches	90
12	Shows confidence in working with problems	82

While categorising the levels of mathematical competencies possessed by their students at the secondary level, a large percentage of teachers stated that the students are at the Novice level (87%); the rest of the teachers stated that the students are at the Basic level (10%), Proficient level (2%), and Advanced level (1%) respectively. As a result, a significant proportion of secondary school students have a negative attitude toward mathematics learning, which has an impact on the explicit processing and cognitive control of the mathematical task at hand.

TABLE 1.2 - OBSERVATIONS AND EVALUATIONS OF THE SELECTED DESIGNS' DESIGN QUALITIES

| Sl. No. | Design Qualities | Designs | | | | | | | | |
| | | Design I (Journaling) | | | Design II (PBL) | | | Design III (Thinking maps) | | |
		Low	Average	High	Low	Average	High	Low	Average	High
1	Product focus	NIL	12%	88%	NIL	11%	89%	NIL	10%	90%
2	Authenticity	NIL	10%	90%	NIL	9%	91%	NIL	8%	92%
3	Organization of knowledge	NIL	4%	96%	NIL	5%	95%	NIL	1%	99%
4	Affiliation	NIL	8%	92%	NIL	7%	93%	NIL	5%	95%
5	Novelty & variety	NIL	10%	90%	NIL	11%	89%	NIL	4%	96%
6	Protection from adverse consequences	NIL	11%	89%	NIL	8%	92%	NIL	9%	91%
7	Choice	NIL	2%	98%	NIL	4%	96%	NIL	2%	98%

According to the above table, all of the selected reflective learning designs and associated lesson designs as perceived by the sample of experts were highly embedded with the set design attributes, which might pave the way for upscaling the mathematics learning space at the secondary school level.

Following that, the professional comments and revisions made by a chosen group of practitioners in relation to the various dimensions of the generated designs were included. Experts with advanced degrees reaffirmed that the chosen designs are capable of teaching secondary school students to be self-reflective learners and to develop a repertoire of deep learning skills. The carefully chosen ideas for enhancing learning opportunities and generating productive learning places are both academically and practically sound. Experts

believe that the educational goal of the PBL design produced for this study stresses the ideals of deep, sustained learning through exposure to real-world circumstances. The choose Thinking maps design has a high reputation for increasing student motivation toward learning tasks and for providing an unrestricted environment by empowering students to create knowledge representations of their learning experiences using integrated graphic primitives. The design of Reflective Journaling encourages students to reflect genuinely, honestly, and deeply on their learning episodes, as well as to identify the processes they could use to extend their knowledge schema where gaps were discovered, allowing for multiple layers of learning management by the students. This argument is further supported by Phan's (2006) observations. The findings in this study widely supported the idea that certain learning designs, such as Reflective journaling, Problem-based learning, and Thinking maps, are highly recommended and can be assessed for their effectiveness in inducing reflectivity among secondary mathematics students.

TABLE 1.3- DATA AND RESULTS OF THE SIGNIFICANCE TEST OF THE MEAN ACHIEVEMENT PRE-TEST SCORES IN THE EXPERIMENTAL I AND CONTROL GROUPS

Sl. No.	Sample	Control group			Experimental group I			Critical Ratio	Level of significance %
		Mean	SD	No. of pupils	Mean	SD	No. of pupils		
1	Total	1.41	0.99	75	1.61	1.02	69	1.18	23.7
2	Urban	1.56	1.07	36	1.91	1.10	34	1.21	23.2
3	Rural	1.33	0.89	39	1.36	0.96	35	0.13	89.5
4	Male	1.51	0.95	37	1.51	0.97	33	0.004	99.7
5	Female	1.27	0.98	38	1.69	1.06	36	1.78	7.9

The critical ratio produced for the complete sample is not significant, as shown in Table 5.6, because the criterion of significance is 23.7 percent. As a result, there is no significant difference in the mean pretest accomplishment scores of the experimental I and control

groups. The critical ratios obtained for the locality and gender sub samples are not significant, as their levels of significance are 23.2 percent, 89.5 percent, 99.7 percent, and 7.9 percent, respectively, as shown in Table 5.6. This demonstrates that the mean pre-test achievement scores of the experimental I and control groups are not significantly different.

The results of the test of significance of pre achievement scores show that for the total sample, locale wise, and gender wise sub samples, the performance of the experimental group I who were exposed to Reflective journaling design and the control group is similar in their pre-experimental status of mathematics achievement measured in terms of pre test.

TABLE 1.4- PRE- AND POST-TEST ACHIEVEMENT SCORES IN THE EXPERIMENTAL I AND CONTROL GROUPS FOR THE TOTAL SAMPLE ANCOVA

Source	Type II sum of squares	df	Mean square	F- value	Significance level %
Model	54564.03 (a)	1	54564.033	262.238	0.01
Control post	54564.033	1	54564.033	262.238	0.01
Error	14143.967	68	208.000		
Total	**68708.000**	**69**			
A R squared = 0.815 Adjusted R squared = 0.805					

The covariance analysis shows that after adjusting for the effect of variation due to differences in pre-experimental mathematics achievement as measured by the covariate, there is a statistically significant difference in post-test scores between the experimental and control groups for the total sample, as well as for locale and gender sub samples This means that in the post-achievement test, the experimental group outperformed the control group.

CONCLUSION

The current study underlines the critical importance of implementing progressive instructional dynamisms in order to resuscitate students' reflective attitudes, which leads to advanced mathematics performance. The study found that certain learning designs, such as

reflective journaling, problem-based learning, and thinking maps, can help students improve their reflective thinking skills at the secondary level. The study also discovered that exposing select learning designs served as a guide to help learners navigate their learning pursuits within a reflective culture, resulting in increased academic achievement in mathematics. The brilliance of reflectivity pierced via the intervention and exploration of select learning designs, causing a surge in the upbringing of mathematical proficiency levels in various strands. The study also found that the reflective mind set's experiencing aspect has an impact on successfully strategizing and creating mathematical task solution paths. The metalearning awareness squeezed through self-analyzing, self-monitoring, and self-management of mathematical tasks energises them to embark on better out comes, allowing backward learners to lift their levels of achievement while maximising the potentials of forward pupils were also discussed and proved.

The study's most notable contribution is that refining young adolescents' thoughts in a reflective tune might empower them with a philosophical mind that has self-control and mastery over their own thinking and views.

LIMITATIONS OF THE STUDY

1) Other than location, gender, and ability groups, secondary school students' sub stratification could not have been addressed because it would have made the study more complicated.

2) Despite the fact that there are numerous reflective learning strategies available, the investigator could only focus on a few of them, namely Reflective Journaling, Thinking Maps, and Problem-Based Learning, because they have been found to be the most effective for secondary school students.

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